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DEPUTY MINISTER OF ENERGY, MINES AND RESOURCES

TO THE

SOUTHWEST ALASKA SECTION, SOCIETY OF PETROLEUM ENGINEERS

AMERICAN INSTITUTE OF MINING, METALLURGICAL, AND PETROLEUM ENGINEERS

ANCHORAGE, ALASKA

May 6, 1971

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INTRODUCTION

An invitation to address an audience in Alaska is one on which I would place a considerable priority at any time because of the fascination and optimism with which I view the present and future prospects of this great northern state. I felt particularly honoured to receive an invitation to present a paper at this Regional Meeting of the Southwest Alaska Section of the Society of Petroleum Engineers because of the major interest of both of our countries in northern oil development matters at this time. We in Canada have been greatly encouraged in our northern oil activities by the success you have already had here in Alaska and we look forward to continuing close liaison and cooperation with you as the two countries proceed with the huge challenge of opening up this vast northern area of the North American continent.

I have been asked by your Program Committee to present a paper on "Oil and Gas in Canada" and think this can possibly best be done in the context of your program themes by first describing briefly the physical development of our industry, then summarizing activities underway relative to northern transportation preparations, followed by reference to some of the policies that shape Canadian oil and gas developments as a whole and some of the objectives related thereto, and finally by referring to some of the expectations and concerns that we have relative to oil and gas developments in Canada and the United States.

CANADIAN OIL AND GAS - A GROWTH INDUSTRY

Although oil was first found in Canada over a century ago, it was not until the discovery of large reserves of crude oil at Leduc, Alberta, in 1947, that the Canadian petroleum industry began to assume major significance in the national economy. Leduc showed the potential for major reserves of oil and gas in western Canada and sparked a surge of exploration that has continued to the present time.

The majority of the oil and gas fields that have been discovered in Canada are located in Alberta with Saskatchewan ranking second in terms of oil reserves, and British Columbia second in terms of gas reserves. In Alberta, the bulk of production and proven reserves are contained in carbonate reefs of Devonian Age, although Upper Cretaceous sandstone reservoirs are also a major source of production.

Following the Leduc discovery in 1947 and the subsequent discovery of other Devonian reef pools, a major new productive trend was established by the discovery of the Pembina field, an Upper Cretaceous sandstone field, in 1953. The discovery of several other Cretaceous and Devonian fields followed, culminating in the large and prolific Devonian Swan Hills reef pool in 1959. The 1960's represented a period of dynamic growth in the Canadian petroleum and natural gas industry and was also highlighted by several important discoveries including the Devonian Gilwood discoveries at Mitsue in 1964 and at

Nipisi in 1965, the Rainbow and Zama oilfields in 1965 and 1966 and the huge Kaybob South, "wet" gas discovery of 1968. Since 1966 there has not been a large oil discovery in Canada although several major natural gas discoveries have been recorded in the Foothills belt of Alberta.

In the decade from 1960 to 1970, proved reserves of liquid hydrocarbons, including crude oil and natural gas liquids have more than doubled from 4.2 billion barrels in 1960 to 10.4 billion barrels at the end of 1970. This estimate does not make any allowance for reserves in the Athabasca Tar Sands. In the face of record production levels, however, the growth of liquid hydrocarbon reserves has moderated in recent years, and in 1970 actually declined for the first time since the discovery of Leduc in 1947. Growth in natural gas reserves has closely paralleled the growth in liquid hydrocarbons and since 1963 proved marketable gas reserves have risen by more than 20 trillion cubic feet to reach 53.4 trillion cubic feet at the end of 1970.

Potential reserve estimates are of particular interest in relation to northern oil development because, of the 120 billion barrel potential, over 40 billion barrels are generally assigned to the Arctic Islands and a considerable portion of the 45 billion barrels thought to occur in the western Canada sedimentary basic represents potential in the northern territories. The estimate of gas reserve potential at 725 trillion cubic feet gives even greater emphasis to possibilities in the north. Add to these possibilities an estimate of some 300 billion barrels of recoverable oil from the

Athabasca Tar Sands and the expectations as to potential volumes are indeed bright although the economic feasibility of this resource potential is, of course, yet to be determined.

The steady growth in oil and gas reserves has been achieved during a period of rapidly rising production rates. During the period that oil reserves have doubled, production has also increased substantially and the 1970 production level of just under 1.5 million barrels daily is almost three times the 1960 output. Under the impetus of major pipeline construction in the late 1950's and rapidly expanding export markets throughout the 1960's, gas production has also shown a remarkable growth rate. Net production in 1970 amounted to 6.2 billion cubic feet daily, more than twice the 1963 production figure.

Since 1947 the Canadian petroleum industry has invested more than $15 billion in the search for and development of new oil and gas resources. During the past five years the search has been gradually shifting from the Prairie Provinces to Canada's "frontier" areas where the risks are greater but the rewards appear to be proportionately much more attractive. These high potential areas include the Mackenzie Delta - Beaufort Sea region, the Arctic Islands and offshore from the east and west coasts of Canada. The results of exploratory drilling on the continental margins have not yet produced a commercial discovery but three discoveries made in the Arctic during 1970 are indicative of the future potential of this

region. An oil discovery was made on the Arctic coast at Atkinson Point in the Northwest Territories. In the Arctic Islands, Panarctic Oils Ltd. is now in its third season of search for oil and gas. Panarctic is an industry-government company consisting of 20 companies in partnership with the federal government which holds a 45 per cent financial interest in the company. Panarctic's exploratory program has yielded two large gas discoveries, the first on Melville Island in 1969 and the second late in 1970 on King Christian Island, and there have been oil and gas shows in other wells.

The current level of exploratory activity in the Arctic Islandsinvolving 8 drilling rigs will increase in tempo and it is anticipated that about 20 exploratory wells will be drilled annually for several years on the Islands. Drilling is also proceeding actively on the northern mainland. In total, there are almost 450 million acres under exploration permits in the Canadian north. Our east coast offshore is also the scene of considerable activity where 21 deep exploratory tests have already been drilled and about 20 more will likely be drilled during the next year or so. Oil and gas permits exceed 280 million acres in this region.

CANADIAN PREPARATIONS FOR NORTHERN PIPELINES

In Canada extensive preparations on the part of both industry and government are underway to ensure that, when the time comes to build oil and gas pipelines in the north, engineering, environmental

and economic knowledge will be on hand to meet industry and government requirements for the successful completion and operation of these pipelines. The voyages of the tanker Manhattan provided valuable information regarding the feasibility of moving oil from Alaska and northern Canada to market via an Arctic marine route but now the emphasis is on southward trending pipelines in Alaska and the Northwest Territories.

The preparations that have been underway in Canada by the federal government were formalized in an announcement made last August by my Minister, the Honourable J.J. Greene, and the Honourable J.J. Chrétien, Minister of Indian Affairs and Northern Development, in the form of a set of pipeline guidelines for northern operation. The guidelines, prepared by the federal government's Task Force on Northern Oil Development, established the concept of a "corridor" within which a trunk oil pipeline and a trunk gas pipeline and related facilities would be located. The guidelines provide for "common" carrier service at published tariffs or a "contract" carrier service at a negotiated price for all oil and gas which might be tendered to the lines. These pipelines are to be within the jurisdiction of the Government of Canada. There will be opportunity for Canadians to participate in the financing, engineering, construction, ownership and management of northern pipeline. A certificate to proceed with construction will be conditioned in respect of preservation of the ecology and the environment and the protection of the rights of northern residents, including opportunities for employment.

In order that the federal government and industry may be adequately aware of the geotechnical problems and the environmental impact of oil and gas pipeline construction and operation through the Mackenzie Valley and adjoining regions, and thus be in a position to ensure that any pipeline project will be ecologically acceptable as well as technologically successful, various government agencies are gathering relevant scientific and technical information, on a priority basis, in this great northern region. In view of the presence of permafrost and muskeg, particular attention is being directed towards terrain conditions along probable routes for the pipeline corridor.

The Geological Survey of Canada, which is part of my Department, has had a northern program for many years. Terrain studies started in the Mackenzie Basin area in 1965 and were expanded in 1969. These studies are concerned with surface and near surface rock and earth materials, ground ice and permafrost, muskeg materials, slope stability hazards, character of river banks and beds, coastal retreat, and near shore sea and lake beds. The purpose of gathering such information, and carefully analyzing it, is to determine the expected performance of the terrain under the impact of pipeline and related petroleum developments. Core drilling, soil mechanics, and geophysics are being used to document the engineering performance of the Arctic terrain.

Related investigations of vegetation, soils and water bodies are being undertaken on a cooperative basis with other government agencies. The Geological Survey work is coordinated with contract investigations supported by the Department of Indian Affairs and Northern Development under its Arctic Land Use Research Program. Other agencies of the federal government active in northern research include the Fisheries Service, the Forestry Service, the Canadian Wildlife Service, the Canadian Water Survey, and the National Research Council of Canada. These and other agencies are working on relationships between land and vegetation for terrain sensitivity surveys, classification of landscape units along pipeline routes according to a schedule of values related to wildlife production and migration, hydrometric data on river systems, investigations of northern aquatic resources, and environmental protection studies concerned with the restoration of plant life in northern regions.

Studies directly related to pipeline performance are also underway. The National Energy Board has carried out analyses to determine suitable pipeline working pressures, spacing of stations for oil pumping, compression, refrigeration and other variables. Particular attention is being given to pipe specifications so that line pipe with the most suitable properties to meet the severe temperature and permafrost conditions of the north will be used. My own Department's research laboratories have carried on a program of steel research for many years with the objective of developing

improved higher strength steel for line pipe. All important properties that could affect the manufacture and performance of pipe have been carefully studied including techniques of welding without the danger of producing brittle joints. Full-scale lengths of pipeline are being evaluated by bursting tests when exposed to all extremes of weather in order to be certain that the processing used to develop the required strength has not reduced toughness. Our scientists stand ready to assist industry in any steel research problems.

In this brief survey of some government programs relative to northern pipelines you will note a wide range of interests which acknowledge the need to ensure that wildlife and the northern terrain will be fully protected and that full and careful attention will be given to practical engineering, economic and safety factors related to the placing of steel pipe in the ground and operating it under extreme conditions of temperature and stress. In short, the government role includes safeguarding the country's natural resources and assisting industry in its difficult engineering and construction problems.

The federal government's preparation for northern pipelines began shortly after the Prudhoe Bay discovery was announced. Early discussions with potential producers were held in an informal way to determine their interest in a Canadian route for oil and gas to continental United States markets. In December 1968 the federal

government established its Task Force on Northern Oil Development to provide for a coordinating and appraisal body to handle the vast amount of information which would become available, to provide for its proper assessment in terms of Canadian interests and to institute appropriate research programs. The programs I have described are under the general surveillance of this Task Force. A unique feature of our northern work is the interdepartmental programming at the federal government level in which the field work and the research of several departments are coordinated by a Program Directorate operating in terms of a joint budget made available specifically for northern research related to pipelines. We believe that this is the best way to generate essential information for industry and government without duplication of work as between government agencies and also so as not to use the taxpayer's dollar for work more appropriately done by industry and yet to provide industry with the research support it needs.

Industry in Canada is involved in extensive research and field assessment studies on its own account. This work can be briefly referred to in terms of the principal projects concerned with oil and gas pipeline feasibility studies.

Mackenzie Valley Pipe Line Limited was formed in June 1969 and is a 17-company consortium participating in technical studies to determine the feasibility of building an oil pipeline from the north. The test site near Inuvik in the Northwest Territories is

designed to provide the information required for the construction and operation of a pipeline in permafrost terrain and includes observations of the effects of moving hot oil through 48-inch diameter test loops put in place by various methods of construction. Mackenzie Valley is also doing research relative to aerial surveys soil analysis, sociological studies, operation and maintenance procedures, and other projects - all concerned with the design, construction and safe operation of oil pipelines in northern areas.

There are three major projects concerned with the feasibility of building gas pipelines from the north.

Northwest Project Study Group is a research group of six companies representing gas producers in the Prudhoe Bay area, Trans-Canada Pipe Lines Limited, and two large United States gas transmission and marketing companies. Its Arctic test facility is at San Sault Rapids in the Mackenzie Valley, about 100 miles north of Norman Wells, where construction and operation tests are being carried out under various conditions. The Northwest Project Study Group is also doing research concerned with temperature investigations, route selections, gas reserve determinations, compressor and refrigeration station design, support systems and operations, ecology and financial feasibility.

Alberta Gas Trunk Line Company has initiated a Gas Arctic Systems Study Group comprised of two large United States gas transmission and marketing companies, Northern National Gas Company

and its own company, in order to carry out research. Its plans include the design and construction of northern research facilities at Prudhoe Bay, Alaska and at Norman Wells, N.W.T. The Alaska test facilities are designed particularly to determine criteria for the transmission of cold gas in a continuous permafrost area. Associated studies will be carried on at the Institute of Polar Studies at Ohio State University. The Norman Wells facilities are to be primarily concerned with thermal problems in an area where temperatures could be both above and below freezing. In addition, this Group is concerning itself with design studies of the route, ecological considerations, capital costs, engineering and operating and maintenance procedures.

The Mountain Pacific Project is planning research on its proposal to move gas from Alaska and possible Canadian sources to markets in the western United States. The members of this Group are Westcoast Transmission Company Limited, Canadian Bechtel Ltd. and three important United States gas transmission and marketing companies. Like the other projects, it is similarly committed to the need for adequate research prior to northern pipeline construction and operation.

Some of the companies engaged in exploration in the north have also done considerable research relative to terrain and ecological conditions as part of their exploration programs and have contributed in a valuable way to knowledge and procedures related to northern oil and gas operations and related supply logistics.

There is good liaison between industry and the federal government on all of this work. The companies sponsoring the pipeline proposals meet regularly with the Task Force on Northern Oil Development to report on progress and to discuss matters of mutual interest to industry and government.

CANADIAN OIL AND GAS POLICY

The growth of the oil and gas industry in Canada during the past 25 years has been stimulated by favourable land disposition, conservation, taxation and trade policies - to name a few of the policy components most directly related to resource development and marketing. The government of the day has, of course, always had to have full regard for the need for adequate supplies of energy at least possible cost. It has also had to weigh carefully the various interests and needs of the several regions of our vast country including the key matters of economic growth and employment. Oil and gas policy must have regard to budgetary priorities and national accounts objectives involving fiscal and monetary criteria. There are trade objectives, too, and cost of living concerns and many, many demands on the central government from all sectors of Canadian society for attention to this or that priority. Of course, this situation is not particularly unique although some would say that a government of a country of 3.8 million square miles, second largest in the world, with large undeveloped resources and with only 21

million people wanting very much to keep up with their next door neighbours who happen to be the wealthiest in the world - that the government of such a country does have some unique problems.

We certainly have some oil and gas resource and marketing problems and our successive governments over the years have tried to deal with them in an effective manner while, at the same time, having regard to some of the other priority areas that I have just mentioned. Geography is the root cause of some of the problems in our oil and gas resource development - as it is in Alaska. Our reserves are far removed from markets and transportation thus becomes a major challenge. As part of the objective of this paper of describing the Canadian oil and gas economy, I would like to indicate to you how we have tried to deal with this matter - sometimes with the help of your great country and sometimes in spite of our differences in objectives.

As our oil resource base grew a decision was taken that, as a matter of national policy, domestic oil should be used as far east as the Ontario-Quebec border. Eastern Canada was to remain dependent on imports of oil from foreign sources thereby providing the eastern part of the country with access to cheaper energy than would have resulted had western Canada crude been transported as far as Montreal. At the same time, in order to expand production as new discoveries were made, the federal government encouraged

industry to develop larger exports in the much closer U.S. mid-west and Pacific Coast markets. This two-directional marketing program was initiated in 1961 as the National Oil Policy and it proved quite successful in the period 1960-69 when production increased from 544,000 to 1.3 million barrels a day. However, as the decade progressed there was a gradual decline in the earlier competitive strength of Canadian oil in the Ontario market and in the spring of 1970 a system of licensing for motor gasoline imports into Ontario was instituted. About the same time, the United States imposed formal controls on imports of Canadian crude into areas east of the Rockies. Continuation of these formal restrictions, following upon informal restrictions which had existed since 1963, called into question a key Canadian policy assumption that exports to the United States would continue to grow at a high rate during the 1970's. The quota on Canadian crude oil for 1971 into Districts I-IV remains at 450,000 barrels a day. The two countries have not resolved this marketing problem.

I mention this matter, without going into details of each country's objectives which account for the different views, in order to take note of the fact that our oil policies do impact on each other. However, in this day of uncertainty in the international oil economy when rather large demands are being made by governments of some oil producing countries, possibly our two countries are not too far apart in the common objective of developing and using the continent's very considerable oil and gas resource potential to the optimum advantage of each nation.

NATIONAL OBJECTIVES

I have referred to some aspects of our oil marketing policy but I would like to put this in the broader context of some of our national objectives as they relate to the oil and gas economy. Canadians, like peoples of many other countries, are calling for a more progressive role on the part of government in the implementation of policies which will improve their economic well-being and the quality of life. In Canada there is increasing conviction of the importance of private enterprise provided it is conducted in terms of the public interest and thus we are encouraging the businessman to interest himself more actively in the formulation of national policies. This is calling for closer cooperation between industry and government because I believe we face in Canada today challenges as basic as any that faced Roosevelt in the New Deal years in the United States when the policies of government worked to shape the most dynamic economy in the world.

As an example of the steps we are taking in Canada to encourage closer industry-government cooperation, my Minister, the Honourable J.J. Greene, formed a National Advisory Committee on Petroleum early in 1970 consisting of senior oil and gas industry officials to advise him on important issues. These executives serve on the Committee as experts on oil and gas matters of national importance and not as company representatives. The value of this form of consultation has been firmly established.

While oil marketing matters, northern pipelines and foreign ownership - to name a few - are 'hot' public policy issues at the moment, they are only expressions of basic questions underlying all energy policy considerations. These questions are concerned with such fundamentals as how fast we develop our energy resources, where we market the product and, in particular, whether we can so manage the whole activity as to ensure sufficient lasting benefits in the form of a changed and more productive national economy in the technologically competitive world of the future. I would like to list a set of inter-related guidelines which may serve to indicate the nature and direction of our national objectives as they relate to oil and gas energy in general.

1. The economic objective is the guideline towards the lowest cost energy mix and the continuing availability of a variety of competing energy sources in adequate supply, with surpluses going to export markets at optimum prices. This is the guideline that calls for economic efficiencies in all sectors of the energy structure from exploration through to final use.

2. The national security objective is concerned with the adequacy and continuity of energy supply in all forms and at all times. On the face of it, this may seem to be solely related to preparation for national or international crises, but it is more in that it also embraces concepts of marketing strategy.

3. The resource adequacy objective is the one most directly concerned with the optimum development of the energy resource base and the incentives and conditions related thereto.

4. The quality of the environment objective has begun to loom very large, indeed, in recent years, as witness the concerns relative to northern pipelines. All planning relative to energy production and use - from Arctic oil exploration to the siting of atomic power reactors, the use of high sulphur coal, and the issue of non-leaded gasoline - must have regard to environmental standards set by Governments thoroughly and realistically aware of the hazards and the non-hazards.

5. The jurisdictional objective in Canada is particularly sensitive and calls for the utmost of cooperation between the federal and provincial governments, and among governments at all levels, to ensure that national objectives in energy production and use are not frustrated by conflicts of a constitutional or legal origin within Canada.

6. The public revenue objective is concerned with appropirate balances as between the needs of public treasuries for maximum revenue returns from energy industry activities on the one hand, and the incentive needs of industry in relation to high-risk resource development and long payout on large capital investments, on the other.

7. The social objective seeks to provide stable Government in which the energy industries and Government can cooperate in mutual reliance. It calls for maximum Canadian participation and, at the same time, good relations with corporations and individuals from other countries who are helping to build the energy economy of Canada. It also is concerned with worker dislocation in times of depressed industrial activity.

THE OIL AND GAS OUTLOOK IN CANADA AND THE UNITED STATES

It is not my purpose to express any specific opinions as to how your Alaskan oil developments or our northern oil developments will work out. I will say, as a matter of principle, that they must proceed in terms of the policies and decisions in each country. Thus, if a decision is taken by government and industry in the United States that the first oil pipeline is to follow an all-Alaska route and then move by tanker, we would accept that decision as representative of your country's wishes even though we felt it might not be the best one for either Canadian or U.S. policy provided, of course, that full environmental protection was guaranteed for any Canadian territory in proximity to your combined pipeline-tanker route. On the other hand, should the decisions favour a Canadian route for the first oil pipeline, the first gas pipeline, or a second oil pipeline, we would undertake to provide the same sort of

assurances that the United States provides for pipelines in parts of your lower 48 States that deliver crude oil and natural gas to Canadian markets.

This matter of pipeline routes will be worked out in terms of the environmental, social, economic, engineering and jurisdictional factors pertaining to each case. However difficult these may seem at the moment, they are not nearly as uncertain as some of the longer-term questions of how each of our countries will meet its future requirements for oil and gas and energy in general.

Among the areas of uncertainty in the United States, the adequacy and conditions of long-term energy supply would seem to be of paramount concern, if one is to judge from the warnings of energy shortage that were heard during this past winter and the numbers of energy studies that are either planned or underway in Washington to examine import quotas, price regulating programs, conservation measures, environmental and other issues. Inasmuch as your energy consumption is rising at almost 5% a year, energy supply indeed becomes a national issue, particularly when one views it in terms of such estimates as those of Wayne E. Glenn who, in his paper presented at the Annual Meeting th AIME in February, forecast a free world oil requirement of 465 billion barrels of crude oil between now and 1990, of which the United States would require some 150 billion barrels. This forecast takes on added meaning when related to present U.S. oil reserves of 50 billion barrels and

a free world total of little more than the expected requirements of the next 20 years. Potential oil and gas resources of the United States are, of course, very large but not recoverable under today's technology and prices. There are therefore many questions as to how future U.S. requirements will be met and the policies to be adopted over the years will have to shape the answers to these questions.

Within Canada we also have many areas of uncertainty as to how our energy resources should be developed and used. Some would stress exports as a means of developing our energy resources and, in view of the aforementioned forecasts, see limited opportunities for energy industry growth, particularly for oil and gas, and great overall benefits to the economy as a whole. Others see the restrictive import policies of the United States of the past decade as continuing, with Canadian resources only to be used as a surge tank to be drawn when international petroleum markets are difficult and cut back when supply conditions improve. Some views are primarily concerned about the extent of foreign control in our oil industry and the high degree of benefits that accrue to the United States from Canadian production. Still others think our reserves should be set aside to meet future Canadian requirements. There is concern in some quarters that our prices in the domestic market, particularly for gas, are subject to upward pressures because we sell in the high-priced U.S. market, while others find this market of great value in providing an incentive to develop our remote, land-locked resources.

These and many other views illustrate the complexity of energy relations between our two countries, particularly in oil and gas. I recognize the concerns expressed in these various viewpoints and I think it is well to have policy concerns expressed on both sides so that each country can work out its own destiny to its best advantage. Because of the huge energy demands that must be met, whatever the forecast that may be accepted, I believe that a balance of objectives can be reached in each country that will not only be to its best advantage but to the advantage also of the other country.

We live in a dynamic world society of unprecedented growth and complexity, and no problems of that society are more complex than the political-economic-social-engineering problems related to energy production and use. I view as one of the most fascinating challenges for man in the next 50 years the question as to how he will work out his problems of energy supply and demand. Because the United States and Canada already have energy-intensive economies, no regions of the world will have greater challenges to meet in solving the energy supply-demand equation than our two countries. However considered, you in Alaska will have a most interesting and important role to play in that process for many years to come.